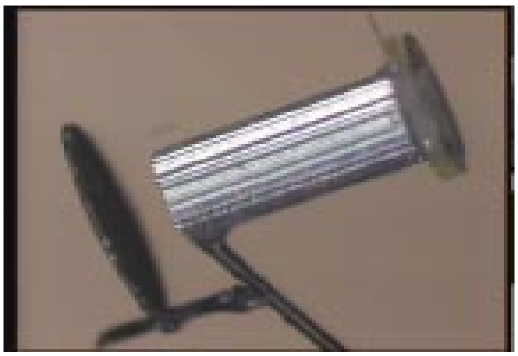
January 1998 Progress Report

Fabrication of Direct Drive Cylinders:

The first direct drive cylindrical implosion targets were successfully fabricated for late January shots at the University of Rochester's Omega laser. The cylindrical targets were particularly unique because of their thin wall and mode 28 perturbations. With an inside diameter of 860 microns and a wall of 20 microns, these polystyrene cylinders were particularly fragile. To ensure their survivability, the polystyrene coated mandrels were annealed three times prior to final mandrel removal. The outer surface of the cylinders was machined with a mode 28 azimuthal perturbation with an amplitude as large as 3 microns. The 2.25 mm long plastic cylinders were coated with 500 A of aluminum that served as a shine shield. They were filled with 60 mg/cc polystyrene foam prior to mounting. The figure shows a mounted cylinder with a composite Ti/Be backlighter/filter combination and lead-doped plastic shield used for an axial radiographic view of the implosion. Extensive metrology of the completed targets (measuring angles to within 0.1˚ and position to within a few microns) ensured that the Omega beams provided the illumination required, and, as is essential with Omega, that all the beams hit the target. A total of 25 cylindrical implosion targets were delivered.



Omega Direct Drive Cylinder Data:

This month a team of Los Alamos scientists joined with their University of Rochester colleagues to perform highly successful direct drive cylindrical implosion experiments on the Omega laser. Beams from the Omega laser were focussed around a central band of the cylindrical target. Using distributed phase plates (DPPs) and smoothing by spectral dispersion (SSD), very symmetric implosions were achieved with convergence ratios of the shell of seven and of the hot spot or axial emission spike of 10. Both unperturbed targets and targets with m=28 1.5 µm sinusoidal perturbations machined on the outer surface were fielded. X-ray radiography done both axially and transverse to the cylinder axis produced excellent movies of the hydrodynamics of the cylinder imploding (see results at right). Twenty-two shots were obtained in this first scoping campaign, including 17 implosions, 15 of which had both excellent energy and power balance. These direct drive cylinders were 900 µm initial diameter, twice the size of cylindrical targets used previously in hohlraum experiments at Nova, and were driven with a 2.5-ns linear ramp pulse. These experiments should effectively benchmark the radius versus time of the LASNEX design calculations, and they should provide the basis for a wide variety of higher resolution convergent hydrodynamics experiments in the future.